The Burden of Exchange Rate Adjustment in Brazil

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In this paper external disequilibrium in Brazil is sketched, the 1979 maxidevaluation is discussed, and a well-known result of open macroeconomic theory is restated, that is, that the cost of a successful devaluation is a reduction in real wages. Whenever real or relative wages are resistant, a devaluation quickly washes out.

THE ECONOMY

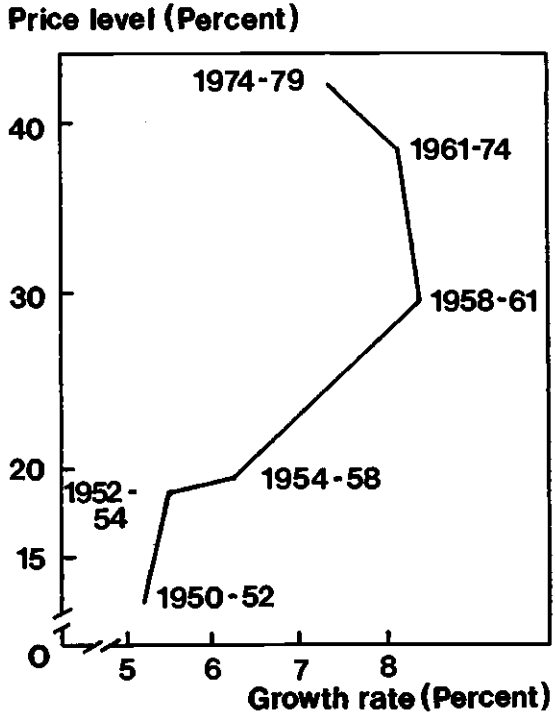
High rates of inflation and a large and growing external debt are the most serious problems that Brazil faces nowadays. During the last 30 years (1950–79), the average rate of inflation in Brazil has been 32 percent annually. Macroeconomic theory predicts that inflation rates tend to become rigid once government adopts accommodating policies in relation to supply and demand shocks, and relative wage stickness makes economic recessions inefficient as a means of reducing inflation. Hence, although inflation rates vary over the business cycles, at the end of each of them they are higher than before. This phenomenon is illustrated in Chart 1, where average rates of inflation and of real growth for each cycle of the Brazilian economy after 1950 are shown.

Table 1 shows inflation and growth rates for the last 12 years. Inflation accelerated in the last six years and growth rates fell relative to the previous period (1968–73). While inflation has been systematically higher, year after year, growth has oscillated, reflecting the stop and go policy of the Simonsen period (1974 to 1979).

Table 2 displays a summary of the Brazilian balance of payments from 1968 to 1979. Up to 1973, the trade balance was in equilibrium. The flow of direct investments and loans exceeded the deficit in the current account, making for an overall surplus and accumulation of reserves.

Chart 1

AVERAGE INFLATION AND GROWTH RATES: BRAZIL, 1950-79



Source: Table I

Table 1

INFLATION AND GROWTH RATES, BRAZIL, 1968-79

Years	Growth rates	Inflation rates
1968-73 (average)	11.5%	19.6%
1974	9.8	28.7
1975	5.6	27.7
1976	9.0	41.3
1977	4.7	42.7
1978	6.0	38.7
1979	6.8	77.2

Sources: Conjuntura Econômica, Banco Central.

Table 2

BALANCE OF PAYMENTS -- 1968-78 (in millions of $US)

	1968-73 average	1974	1975	1976	1977	1978	1979
Trade balance (f.o.b.)	-5	-4,690	-3,499	-2,255	97	-1,024	-2,717
Exports	3,338	7,951	8,670	10,128	12,120	12,659	15,244
Imports	-3,343	-12,641	-12,169	12,383	12,023	13,683	-17,961
Service balance	-992	-2,433	-3,213	-3,763	-4,134	-4,975	-7,780
Interest payments (gross)	(-386)	(-1,370)	(-1,828)	(-2,039)	(-2,462)	(-3,329)	(-5,537)
Unrequited transfers	20	1	0	1	0	72	47
Current account deficit (1 + 2 + 3)	-977	-7,122	-6,712	-6,017	-4,037	-5,927	10,450
Net capital flow	1,880	6,254	6,161	6,806	5,269	9,439	7,940
Errors and omissions	143	-68	-399	403	-602	369	315
Surplus or deficit	1,046	-936	-950	1,192	630	3,880	-2,195

Source: Banco Central do Brasil

In 1974, the oil shock and an increasing demand for imports doubled import spending. Although exports grew 28 percent in that year, the trade deficit was substantial, as was the deficit in services. Consequently the external debt doubled. Between 1974 and 1978, export revenues covered only four-fifths of import spending.

The growth differential between Brazil and its main trade partners lies behind the trade deficits since 1974. Exports have not only been negatively affected by world recession, but also by domestic cyclical effects. Equations estimated by Cardoso and Dornbusch [2] point to a direct adverse effect of domestic demand expansion relative to export capacity.

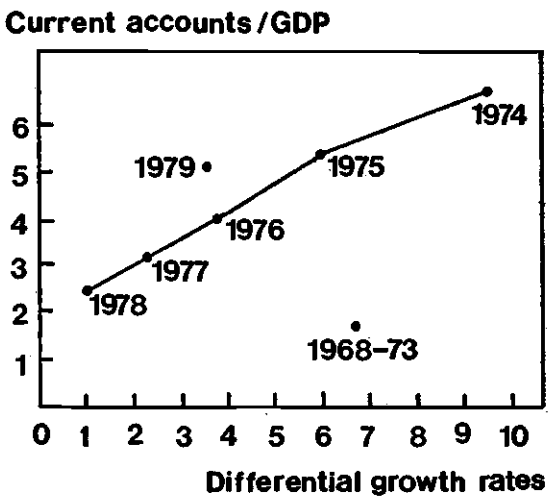
More than the trade deficits, the adverse behavior of the services account contributed to the deterioration of the current balance. Chart 2 shows the share of the current account deficit in GDP. Between 1968 and 1973, this share was 1.7 percent, and the growth differential between Brazil and the OECD countries was a plus 6.7 percent. In 1974, as the growth differential increased and Brazilian terms of trade deteriorated, the share of the current account deficit in GDP rose to 6.7 percent. From 1976 on, the growth differential fell (see Table 3) and the terms of trade improved (due to coffee prices), contributing to a reduction of the current account deficit. Nonetheless, the share of the deficit in GDP during the more recent period has always been higher for the same growth differentials during the previous period (1968–73). The explanation lies in the rapid growth of interest payments, reflecting both the fast growing external debt and the higher cost of foreign capital. Interest payments as a share of total debt service in a given year rose from 4 percent to 5 percent in the late 1960s to 8 to 9 percent in more recent years.

The Brazilian government adopted an accommodating policy in relation to balance of payments problems. Economic policy sustained economic activity in the face of adverse shocks such as the oil price increases of 1973–74 and 1978–79. The behavior of the current account reflects the option of keeping growth rates high, even at the cost of an increasing external debt.

Up to mid-1979, the government did not use an active devaluation policy. Since 1968, a system of minidevaluations was followed, in which the exchange rate was adjusted periodically, based on the inflation differentials between Brazil and the rest of the world. The result of this policy is illustrated in Chart

Chart 2

CURRENT ACCOUNT AND DIFFERENTIAL GROWTH RATES, 1968–79



Source: Table 3

Table 3

CURRENT ACCOUNT GROWTH AND TERMS OF TRADE, BRAZIL, 1968–78

Years	Current account GDP	Brazilian real growth rate	OECD growth rate	Terms of trade (including coffee)	Terms of trade (excluding coffee)
1968–73 (average)	1.7	11.5	4.8	111.2	104.5
1974	6.7	9.8	0.5	103.1	99.0
1975	5.4	5.6	-0.4	100.0	100.0
1976	4.1	9.0	5.1	111.7	97.1
1977	2.5	4.7	3.7	131.7	106.5
1978	3.1	6.0	3.7	115.5	98.2
1979	5.1	6.8	3.3		

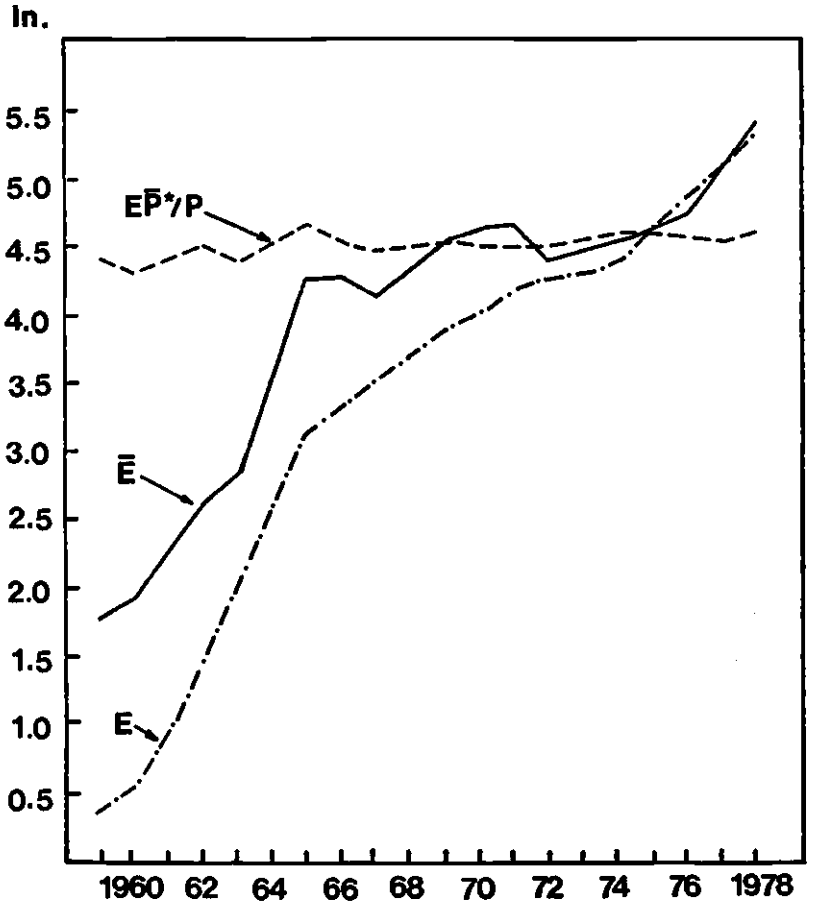
Sources: Conjuntura Econômica and OECD Economic Outlook

3 which shows the nominal and real effective exchange rates for Brazil between 1959 and 1978.[1] The policy of a crawling peg, designed to offset inflation differentials through exchange depreciation, is quite evident from inspection of Chart 3.

The outstanding fact about the relative cost index is its substantial variability prior to 1968 and the subsequent relatively stable behavior. The explanation for the difference in behavior is clearly the exchange rate regime of Brazil. Until 1968 exchange rate policy was one of infrequent, large depreciations that were

Chart 3

NOMINAL AND REAL EFFECTIVE EXCHANGE RATES: BRAZIL, 1959–78 (1975 = 100)



$E\bar{P}^*/\bar{P}$ = Real effective exchange rate.
$\bar{E}$ = Nominal effective exchange rate.
E = Nominal dollar exchange rate.

designed to undo the loss in competitiveness due to domestic inflation. From 1968 until late 1974 the minidevaluation policy substantially smoothed that process.

The reluctance to use devaluations to stimulate exports and discourage imports is understandable, given its undesirable effects on inflation. The consequences of changing toward an active devaluation policy[2] are discussed in the next sections.

THE PROBLEM

To judge from the preceding section, prospects for the Brazilian current account look bleak. Policies to correct trade deficits usually consist of either a contraction in aggregate demand, that reduces imports temporarily, or a change in relative prices, that would stimulate exports and discourage imports. The government's policy commitments eliminates the first possibility. The official view is that it is possible to correct the external disequilibrium through a change in relative prices, obtainable through a devaluation. That belief lies behind the 30 percent devaluation of December 1979.

Obviously, the positive effect of a devaluation can only be achieved if it is actually translated into an increase in the price received by the exporter in relation to the cost of production, inducing an increase in employment and thus, an increase in income relative to spending.[3]

It is worth observing that a nominal devaluation increases the cruzeiro price received by the exporter, but it also increases the cruzeiro cost of imported intermediates. This implies that even immediately after the devaluation, the real or effective depreciation is smaller than the nominal one. Beside that, the increase in the price of intermediates not only raises the production costs for exporters, but it also raises the cost of production for other domestically consumed goods, inducing an increase in the cost of living. If wages are indexed to the cost of living, production costs will rise further, reducing the effect of the devaluation. Devaluations are soon washed out in an economy where wages are perfectly indexed.

This point can be readily illustrated by the use of a very simple model.

Assume the economy uses labor and an imported intermediate for the production of a good. The price of output and labor are respectively P and W. The supply of imported intermediates is infinitely elastic at a given world price $P_M^* \equiv 1$; thus its price in domestic currency is equal to the exchange rate, E.

The supply of gross output, Q, is an inverse function of the real wage rate and of the real exchange rate:

$$Q = Q(W/P, E/P).$$

Output can be sold at home or abroad. Domestic demand depends on real income, defined as $y = Q(1 - \theta)$, where θ is the unit share of intermediates in gross output. Foreign demand depends on the price of competing goods, $P^* \equiv 1$, relative to the price of the good in dollars, P/E. Total demand for goods is given by:

$$Q^d = D(y) + X(E/P).$$

Equilibrium in the goods market implies $Q = Q^d$ and can be represented by the upward schedule KK in Chart 4, for a given nominal wage rate, W.

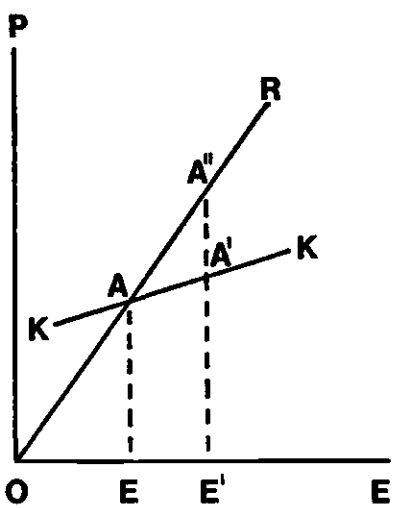
Since the price level is a weighted average of the wage and exchange rates, the real exchange rate, E/P, that corresponds to a constant real wage rate, $W/P = w$, can be represented by the ray OR in Chart 4.

Assume the economy is initially at A. A depreciation of the exchange rate creates excess demand for our good and pushes its price up. The economy moves to A', where employment and output are higher than before, at the cost of a reduction in the real wage rate. At A' there is an improvement in the trade balance, because domestic demand rises less than proportionally with income. But, if wages are indexed to the price level, the nominal wage rate increases, KK shifts up and the economy moves to A'', where the effects on employment and the trade balance disappear.

Although Brazilian minimum wages follow a government indexation rule, it has been argued that most wages are not fully affected,[4] and that they are less than perfectly indexed, leaving room for the devaluation to be effective.

In the next section I present a model where wages are not determined by an

Chart 4



indexation rule: I assume that relative wages of skilled and nonskilled labor are sticky. A supporting description of wages behavior in Brazil is found in [1].

The model in the next section also incorporates other assumptions relevant to the Brazilian economy. It is shown that a devaluation cannot change the real exchange rate, except in the very short run, if wages behave as described. Thus, maxidevaluations are not the appropriate policy for moving relative prices and correcting the Brazilian trade deficit.

THE MODEL

This section builds a model for an economy where an imported intermediate is used for production of a good that is consumed at home and abroad. Demand for exports is less than infinitely elastic. Nonskilled labor is less than fully employed and relative wages are sticky.

Gross output, Q, is produced by combining skilled labor, S, nonskilled labor, N, and an imported intermediate, M. There is substitution between skilled and nonskilled labor, but the imported intermediate, whose supply is infinitely elastic at a given world price, is used in fixed proportions. Thus.

$$Q = \min[F(N, S), 1/\gamma M] = F(N, S), \tag{1}$$

where γ is the quantity of intermediates necessary to obtain one unit of output, Q.

The cruzeiro price of the imported intermediate is equal to its international price, P_M^*, times the exchange rate, E. Assuming $P_M^* \equiv 1$, the cruzeiro of the imported intermediate is E. The price of output, skilled labor, and nonskilled labor are respectively P, W_s, and W_n.

Profit maximization entails equality between the net marginal product of each kind of labor and its real wage. Defining $\theta \equiv \gamma E/P$, I can write

$$(1 - \theta)F_n(N, S) = W_n/P. \tag{2}$$

$$(1 - \theta)F_s(N, S) = W_s/P. \tag{3}$$

Output can be sold at home or abroad. Domestic demand depends on real income, defined as $y = (1 - \theta)Q$. Foreign demand depends on the foreign price of competing goods, P^*, relative to the price of the domestically produced good, in dollars, P/E. (Hereafter this latter good is called "our" good. Assuming $P^* \equiv 1$, foreign demand for "our" goods varies positively with E/P. Total demand for "our" goods is given by[5]

$$Q^d = D(y) + X(E/P). \tag{4}$$

In equilibrium,

$$Q = Q^d. \tag{5}$$

The downward sloping schedule QQ in Chart 5 represents equilibrium in "our" goods market as an inverse relationship between the two wage rates, for

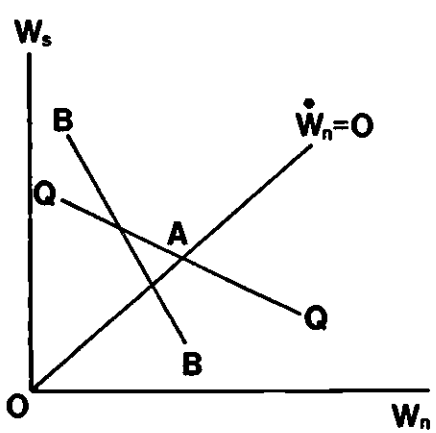
a given exchange rate and full employment of the skilled labor force.[6] Assume an initial ratio between the wage rates, for which the goods market is in equilibrium (given the exchange rate and full employment of skilled labor). If the wage rate of nonskilled labor increases, employment falls and output is reduced. The reduction in domestic demand is smaller than the fall in output, since the marginal propensity to spend is less than one. Besides that, an increase in the wage rate of nonskilled labor raises the price of "our" goods, increasing real income and domestic demand. Those two effects contribute to generate excess demand in the goods market. But there is still a third effect to take into account. As the price of "our" goods rises, foreign demand falls, generating excess supply. Given an elastic demand for "our" exports and low substitutability, that third effect is stronger than the first two. In that case, a rise in the wage rate of nonskilled labor generates excess supply in the market for our goods.[7] To restore equilibrium, the wage rate of skilled labor has to fall, thus reducing the price of "our" goods and restoring demand for exports, at the same time as output rises.

Now look at the external accounts. In the absence of capital flows, the real balance of payments reduces to the real trade balance, B, which is equal to real exports minus the real imports of intermediates necessary to produce both exports and domestically demanded output, that is,

$$B = X(E/P) - \theta[D(y) + X(E/P)]. \tag{6}$$

The BB schedule in Chart 5 represents trade equilibrium, $B = 0$, for a given exchange rate and full employment of skilled labor force, as an inverse relationship between the two wage rates.[8] Assume an initial trade equilibrium. A rise in the nonskilled wage generates a deficit: as "our" price rises, export falls. Importation of intermediates also falls, but less than exports. To restore equi-

Chart 5



librium, the wage rate of skilled labor has to fall, restoring competitiveness of our exports.

Also observe that BB is steeper than QQ. The reason is the following: Moving along QQ, to the right of the point where the two schedules intersect, the unskilled labor wage rate rises and output falls. Since demand falls less than proportionately with output, points along QQ, to the right of the intersection point, represent excess of spending over income, that is, trade deficits.

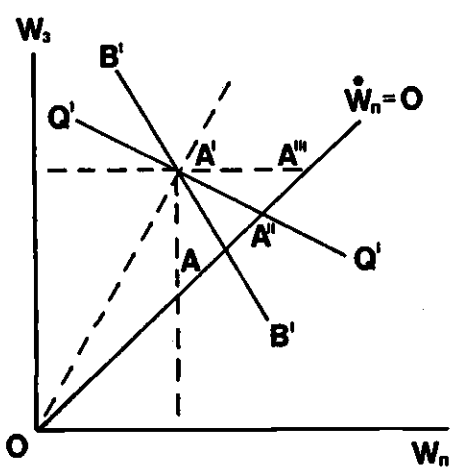
We complete the model assuming that relative wages are sticky and that the wage rate of unskilled labor rises whenever it is below a given fraction of the wage rate of skilled labor:

$$\dot{W}_n = R(\mu W_s - W_n). \tag{7}$$

In Chart 5, $\dot{W}_n = 0$ is represented as a ray through the origin. Short-run equilibrium is shown at point A, where the skilled labor force is fully employed, the wage rate is consistent with desired relative wages, and there is a trade deficit.

I next explore the effects of a devaluation, beginning by looking at the impact of the devaluation in goods market equilibrium. An increase in the exchange rate raises foreign demand but reduces domestic demand through a deterioration of real income. Since the first effect is assumed stronger than the second, a devaluation generates excess demand in the market for "our" goods. An increase in the wage rate of skilled labor restores equilibrium in "our" goods market, as it reduces foreign demand through its impact on the price level and augments supply as relative wages move, inducing more employment of unskilled labor. This implies that a devaluation shifts QQ up,[9] as shown in Chart 6, to $Q'Q'$.

Chart 6



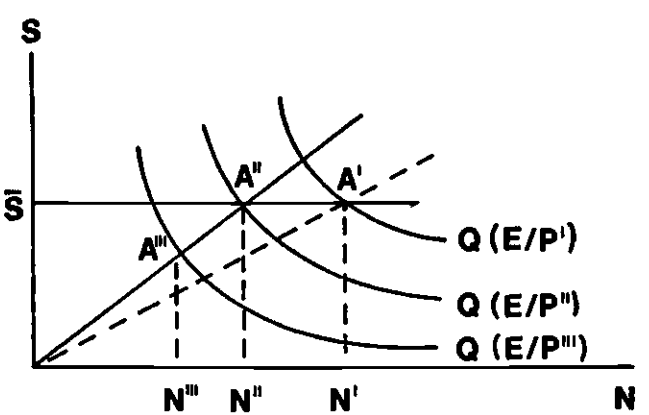
Let us now look to the effects of the devaluation on the *BB* schedule: for given wage rates, an increase in the exchange rate expands net exports while the importation of intermediates for the production of domestically demanded output falls, because of the deterioration of real income. An increase in the wage rate of skilled labor restores trade balance equilibrium, as it reduces net exports and raises imports. These facts imply an upward shift of the *BB* schedule,[10] as shown in Chart 6.

As shown in Chart 6, so long as the wage rate of unskilled labor is held constant, a devaluation increases demand for "our" goods. The wage rate of skilled labor and the price level rise, and, as the real wage for unskilled labor falls, employment expands. As output expands more than spending, the trade balance improves.[11] This is illustrated by the shift from A to A' in Chart 6.

But A' is not an equilibrium point, since relative wages are different from those desired. Hence, the wage rate of nonskilled labor increases and both the gain in competitiveness and the improvement in the trade balance are lost. If the wage rate of skilled labor is fully flexible, the economy moves to A'', where both wage rates and the price level will have increased by the same amount as the exchange rate, leaving employment and the trade balance unchanged.

Now take into account the case where nominal wage rates are rigid downward. As the wage rate of nonskilled labor rises to restore desired relative wages, and the wage of skilled labor does not fall, we move to A''', where there is unemployment in both labor markets, because for the given exchange rate, real wages are too high to permit full employment. A''' also represents excess supply of "our" goods, because, for the given exchange rate, "our" price level is too high to make "our goods" competitive. Suppliers would like to sell more at the going prices, but they are demand-constrained and output is reduced, as illustrated in Chart 7.

Chart 7



A''' represents a Keynesian "equilibrium," where output is demand-determined and there is unemployment of both kinds of labor.

Although the devaluation would have improved the trade balance in the very short run, at the cost of a reduction in the wage rate of nonskilled labor, its results in the long run look bleak. Not only its effects on the trade balance disappear, but a devaluation may well induce a reduction in employment and a further deterioration of the trade balance. This will be the case if, exports being highly demand-elastic, the wage rate of the fully employed skilled labor force overshoots the devaluation and is downward rigid.

CONCLUSIONS

The oil shock affected the Brazilian trade balance badly. Between 1968 and 1973, policies of indexation and public investment coincided with an international boom, resulting in the so-called Brazilian miracle: in those years, real GDP grew on average 11.5 percent annually, inflation rates were kept under control, and exports, after 20 years of relative stagnation, grew 24.6 percent a year. Since 1974, internal and external shocks reverted the behavior of macro variables. Growth rates fell, inflation accelerated, and external accounts severely deteriorated. By mid-1979, faced with large trade deficits and a growing external debt, the government turned to an active devaluation policy.

In this paper I have argued that a devaluation can improve the trade balance in the short run, at the cost of a reduction in the real wage of unskilled labor, as long as unskilled labor can substitute for skilled labor.

If there is no possibility of substitution between the two kinds of labor, the level of output is determined by full employment of the skilled labor force and a devaluation simply transfers income from nonskilled to skilled labor, leaving the trade deficit unchanged.

If there is the possibility of substitution, as long as the real wage rate of unskilled labor falls, employment expands and the trade balance improves. As the wage rate of nonskilled labor rises to restore historically determined relative wages, the trade balance improvement is lost. On the other hand, the wage rates of skilled labor could overshoot the devaluation. As they are downward rigid, domestic prices would tend to rise more than the devaluation, after the adjustment of all wages. Adverse effects on competitiveness and employment would result. I can thus conclude that an active devaluation policy is not the right instrument to move relative prices in Brazil and that, once it is coupled with wage earners' attempts to restore relative wages, it will lead to an acceleration of inflation.

NOTES

* I am indebted to Rudi Dornbusch for comments.

1. The nominal effective exchange rate, E', was constructed as the trade-weighted index of the cruzeiro price of foreign exchange $E = E \sum_{i=1}^{8} a_i E_i$, where E_i is the index of the dollar price of the ith currency and E is the index of the cruzeiro price of the US dollar. The dollar exchange rates are reported in the *IFS* Yearbook. The real effective exchange rate is defined as $E\bar{P}^*/\bar{P}$, where $\bar{P}$, the Brazilian index for wholesale prices, is an index in cruzeiros reported in *Conjuntura Econômica*, Column 2; $\bar{P}^*$, the foreign wholesale price is a trade-weighted average of wholesale prices of the main trading partners. I used moving weights for three periods and converted the price indexes into $US using the respective countries' dollar exchange rate. The resulting index of foreign prices, $\bar{P}^*$ was then converted at the official exchange rate into cruzeiros to yield $E\bar{P}^*$. For details and data see [3] which develops and interprets various alternative measures of the real exchange rate.

2. An estimate of the real exchange rate in manufacturing reported by Morgan Guaranty shows a substantial real depreciation in the last year. See Morgan Guaranty, *World Financial Markets*, January 1980.

3. This argument applies to a less than fully employed economy. In the full employment case, a devaluation will only be effective if combined with an expenditure-reducing policy. See, for example, [4].

4. See, for example, [5].

5. The model leaves aside nontraded goods and imported final goods. Nonetheless substitution effects are already captured by a price elastic demand for exports.

6. To obtain the slope of QQ, substitute Equations (1) and (4) into (5). Differentiate totally the system formed by Equation (2), (3), and (5), assuming $dS = dE = 0$. It follows that

$$N(1-\theta)\,F_{nn}\,N' + [(W_n/P) + \theta\,F_n]\,P' - (W_n/P)\,W_n' = 0. \tag{2'}$$

$$N(1-\theta)\,F_{sn}\,N' + [(W_s/P) + \theta\,F_s]\,P' - (W_s/P)\,W_s' = 0. \tag{3'}$$

$$\alpha_n\,\Psi\,N' + \lambda\,P' = 0, \tag{5'}$$

where $\theta = \lambda\,E/P$; $\Psi \equiv 1 - q(1-\theta)$ with $q \equiv \partial D/\partial y$; $\lambda \equiv \xi - q\theta$ with $\xi \equiv (\partial X/\partial E/P)\,[(E/P)/Q]$; and $\alpha_n \equiv N\,F_n/Q$; $\alpha_s \equiv S F_s/Q$; $\alpha_n + \alpha_s = 1$.

Observe that $F_{nn} = -(S\,F_n\,F_s)/(N\,Q\sigma)$ and $F_{sn} = (F_n\,F_s)/(Q\sigma)$, where σ is the elasticity of substitution between N and S. Obtain expressions for N' and P' as functions of W_s' and W_n' from Equations (2') and (3'), which can be substituted into Equation (5) to get

$$W_s'/W_n' \mid QQ = [\Psi\,\sigma - \lambda\,(1-\theta)]/[\Psi\sigma + \lambda(1-\theta)(\alpha_s/\alpha_n)].$$

7. The condition for excess supply to occur when the wage rate of nonskilled labor rises is that $\lambda(1-\theta) > \Psi\sigma$. Values for the elasticity of substitution between the two kinds of labor less than or equal to one, and values for the elasticity of demand for our exports greater than or equal to one are sufficient for that condition to hold true. In what follows I assume that QQ slopes downward. The reader can easily work out the case in which it slopes upward.

8. To obtain the slope of BB I differentiate Equation (6) totally, assuming $dE = dS = 0$, and $B = 0$.

$$[-\xi(1-\theta) + \theta]P' - \theta q\,dy/Q = 0. \tag{6'}$$

Observe that Equation (6) can also be written as $B = y - D(y)$. Trade equilibrium implies equality between income and spending. Since the marginal propensity to spend is less than one, $B = 0$ only if $dy = 0$.

From Equation (2′) and (3′), I obtain an expression for P' as a function of W_s' and W_n' which I can substitute into Equation (6′):

$$(W_s'/W_n') \mid BB = -(\alpha_n/\alpha_s)$$

9. The upward shift of QQ is measured by

$$(W_s'/E') \left| \begin{matrix} QQ = [\lambda(1-\theta)]/[(1-\theta)\lambda\alpha_s + \Psi\sigma\alpha_n]. \\ W_n' = 0 \end{matrix} \right.$$

10. The upward shift of BB is measured by

$$(W_s'/E') \left| \begin{matrix} BB = [1/(1-\theta)\ \alpha_s]. \\ W_n' = 0 \end{matrix} \right.$$

11. Changes in W_s, P, N, and B induced by the change in E, for a constant W_n are given by

$$W_s'/E' = (1-\theta)\ \lambda/[(1-\theta)\ \lambda\ \alpha_s + \sigma\Psi\alpha_n] > 0;$$

$$1 > P'/E' = [(1-\theta)\lambda\alpha_s + \sigma\Psi\ \alpha_n\ \theta]/[(1-\theta)\lambda\alpha_s + \sigma\Psi\alpha_n] > 0.$$

$$N'/E' = [(1-\theta)\ \lambda\ \sigma]/[(1-\theta(\lambda\alpha_s + \sigma\Psi\alpha] > 0;$$

$$dB/Q = [-\xi\ (1-\theta) + \theta]\ [P' - E'].$$

Observe that, if $\sigma = 0$, then $W_s' = (1/\alpha_s)E'$; and $P' = E'$, $N' = dB/Q = 0$.

This means that if there is no possibility of substitution between the two kinds of labor, then a devaluation simply transfers income from nonskilled to skilled labor and leaves both employment and the trade deficit unchanged.

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